

CLAIMS

What is claimed is:

1. In a computing system including a primary computer system having a primary mass storage device where data blocks are stored and a backup computer system having a backup mass storage device where a backup copy of the data blocks is stored, a method for restoring data blocks that are lost at the primary mass storage device, the method comprising the acts of:

after losing the data blocks at the primary mass storage device, receiving a first read request that would otherwise be processed by the primary computer system;

transmitting the first read request to the backup computer system;

as the backup computer system returns one or more data blocks from the backup mass storage device in response to the read request, writing the one or more data blocks to a mass storage device associated with the primary computer system;

prior to a full copy of the data blocks of the backup mass storage device being restored to the mass storage device associated with the primary computer system, performing the acts of:

receiving a second request, wherein the second read request is for at least one of the one or more data blocks that have been written to the mass storage device associated with the primary computer system; and

responding to the second read request using the mass storage device associated with the primary computer system.

2. A method as recited in claim 1, further comprising the act of restoring the full copy of the data blocks to the mass storage device associated with the primary computer system

by transmitting at least some of the data blocks from the backup computer system to the primary computer system using a communication link other than a link that was used to transmit the first read request to the backup computer system.

3. A method as recited in claim 2, wherein the act of transmitting at least some of the data blocks is conducted such that the one or more data blocks previously written to the mass storage device associated with the primary computer system are not included in the at least some of the data blocks.

4. A method as recited in claim 2, wherein the communication link used to transmit said at least some of the data blocks is faster than the link that was used to transmit the first read request to the backup computer system and has been brought on-line temporarily to restore the full copy of the data blocks.

5. A method as recited in claim 1, wherein the mass storage device associated with the primary computer system is different from the primary mass storage device.

6. A method as recited in claim 4, wherein the mass storage device associated with the primary computer system is a new mass storage device installed to replace the primary mass storage device.

7. A method as recited in claim 1, wherein the mass storage device associated with the primary computer system is the primary mass storage device.

8. A method as recited in claim 1, further comprising, prior to the full copy of the data blocks of the backup mass storage device being restored to the mass storage device associated with the primary computer system, further performing the acts of:

- receiving a write request;
- executing the write request on the mass storage device associated with the primary computer system; and
- transmitting the write request to the backup computer system such that the write request can be executed on the backup mass storage device.

9. In a computing system including a primary computer system having a primary mass storage device where data blocks are stored and a backup computer system having a backup mass storage device where a backup copy of the data blocks is stored, a method for restoring data blocks that are lost at the primary mass storage device, the method comprising the acts of:

once the data blocks have been lost from the primary mass storage device, the primary computer system accessing the backup mass storage device such that read requests that would have been directed to the lost data blocks are instead directed to the backup mass storage device;

the primary computer system copying data blocks read from the backup mass storage device to create a present copy of the data blocks in the primary mass storage device;

the primary computer system tracking which read data blocks have been copied to the primary mass storage device using an overwrite map;

creating a static snapshot copy of a selected data set of the backup mass storage device, the static snapshot copy preserving the selected data set as the selected data set existed at a time after the data blocks were lost at the primary mass storage device; and

copying the static snapshot copy to the primary mass storage device except for data blocks that are indicated to be current in the overwrite map.

10. A method as recited in claim 9, further comprising an act of the primary computer system writing a new data block to at least one of the lost primary data blocks, so as to cause the new data block to be stored both on the primary mass storage device and the backup mass storage device.

11. A method as recited in claim 10, further comprising an act of indicating in the overwrite map that the location of the new data block is current.
12. A method as recited in claim 9, further comprising an act of physically transporting the static snapshot copy to the primary computer system.
13. A method as recited in claim 9, wherein the act of the primary computer system accessing further comprises an act of the primary system accessing the static snapshot copy through at least one of a computer network and a telephone line.
14. A method as recited in claim 9, wherein the selected data set represents the entire backup mass storage device.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

15. A computer system having the capability of restoring data blocks that have been lost from a primary computer included in the computing system, the computer system comprising:

a primary computer having a primary mass storage device where data blocks are stored;

a backup computer having a backup mass storage device where a backup copy of the data blocks is stored prior to the primary mass storage device losing one or more data blocks; and

a transport link for communicating between the primary computer and the backup computer, such that when the primary mass storage device loses one or more data blocks, the primary computer and the backup computer communicate over the transport link to perform the acts of:

directing read requests of the one or more lost data blocks to the backup mass storage device;

writing at least one data block read from the backup mass storage device to the primary mass storage device;

taking a first snapshot of the backup mass storage device for preserving the backup data blocks as the backup data blocks existed at a time after the one or more data blocks were lost;

creating a first snapshot copy of the backup data blocks for transferring the backup data blocks to the primary computer;

identifying any of the data blocks in the first snapshot copy that correspond to data blocks the primary computer has not written to the primary

mass storage device subsequent to the primary mass storage device losing the one or more data blocks; and

making the identified data blocks available to the primary computer.

16. A system as recited in claim 15, wherein making the identified data blocks available to the primary computer further comprises copying the identified data blocks from the first snapshot copy to the primary mass storage device.

17. A system as recited in claim 15, wherein, when the primary mass storage device loses the one or more data blocks, the primary computer and the backup computer communicate over the transport link to further perform the act of writing to at least one of the one or more lost primary data blocks such that the at least one written data block is stored both on the primary mass storage device and the backup storage device.

18. In a primary computer system having a primary mass storage device where data blocks are stored, wherein the primary computer is included in a computing system that also includes a backup computer system having a backup mass storage device where a backup copy of the data blocks is stored, a method for restoring data blocks that are lost at the primary mass storage device, the method comprising the acts of:

experiencing loss of data blocks from the primary computer system;

accessing the backup mass storage device such that read requests that would have been directed to the lost data blocks are instead directed to the backup mass storage device;

receiving data blocks read from the backup mass storage device and copying the received data blocks to create a present copy of the data blocks in the primary mass storage device;

tracking which received data blocks have been copied to the primary mass storage device using an overwrite map;

receiving from the backup computer system a static snapshot copy of a selected data set of the backup mass storage device, the static snapshot copy preserving the selected data set as the selected data set existed at a time after the data blocks were lost at the primary mass storage device; and

copying the static snapshot copy to the primary mass storage device except for data blocks that are indicated to be current in the overwrite map.

19. A method as recited in claim 18, further comprising the act of writing a new data block to at least one of the lost primary data blocks, so as to cause the new data block to be stored both on the primary mass storage device and the backup mass storage device.

20. A method as recited in claim 19, further comprising the act of indicating in the overwrite map that the location of the new data block is current.

21. A method as recited in claim 18, further comprising an act of physically transporting the static snapshot copy to the primary computer system.

22. A method as recited in claim 18, wherein the act of the accessing further comprises the act of accessing the static snapshot copy through at least one of a computer network and a telephone line.

23. A method as recited in claim 18, wherein the selected data set represents the entire backup mass storage device.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111